REMARKS

Claims 1-58 are presently pending in the application. Claims 11-14 and 23-50 are withdrawn from consideration.

At the outset, the Examiner's attention is directed to the Supplemental Information Disclosure Statement filed herewith. Consideration of the references cited therein is respectfully requested.

In the Office Action, the Examiner has rejected claims 1-6 under 35 U.S.C. § 103(a) as being unpatentable over each of JP 63-266034 ("JP '034), JP 63-266035 ("JP '035"), and JP 63-270437 ("JP '437"), collectively "the primary references". Further, claims 7-10 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over any of the primary references in view of JP 11-306940 ("JP '940"), and claims 15-18 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over any of the primary references in view of GB 2028608 ("GB '608"). The Examiner has further rejected claims 19-22 under 35 U.S.C. § 103(a) as being unpatentable over any of the primary references in view of JP '940 and further in view of GB '608, and claims 51-54 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over any of the primary references in view of JP 40-3110732 ("JP '732"). Finally, claims 55-58 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over any of the primary references in view of JP '940 and further in view of JP '732. Applicant respectfully traverses these rejections and the arguments in support thereof for the reasons set forth previously, which Applicant relies upon in full, and for the additional reasons which follow, and respectfully requests reconsideration and withdrawal of the rejections.

Rejections of Claims 1-6 Under § 103(b) Based on JP '034, JP '035, and JP '437

The Examiner argues that JP '034 teaches fuse compositions which overlap with the claimed compositions, allegedly teaching a fuse element consisting of a small amount of copper and balance one or more of Pb, Bi, In, Cd, Sb, and Sn. The Examiner argues that the fuse composition consisting of Cu, Sb, In, Sn, and Bi does not contain Pb or Cd as required. The Examiner demonstrates in Table 1 below that the compositions of JP '034 and the presently claimed composition overlap.

Table 1: Examiner's Comparison of JP '034 Alloy and Presently Claimed Alloy

Element	Present Invention	JP '034	Overlapping Range
Claim 1		abstract	
In	15-37%	0.01-30%	15-30%
Sn	5-28%	0.01-40%	5-28%
Bi	balance	0.01-50%	26.5-50%
Claim 2		abstract	
Cu	0.1-3.5%	0.01-2%	0.1-2%
Sb	0.1-3.5%	0.01-15%	0.1-3.5%

Therefore, the Examiner concludes that it would have been obvious to one skilled in the art to select the claimed alloy fuse composition from the disclosed ranges of JP '034 because JP '034 teaches the same utility (an alloy fuse composition) throughout the whole disclosed range. The Examiner also argues that the fuses of JP '034 are formed from alloys and would inherently be sensitive to temperature and thus qualify as alloy type thermal fuses.

The Examiner argues that JP '035 also teaches fuse compositions which overlap with the claimed compositions, allegedly teaching a fuse element consisting of a specified amount of Al, Au, or Ag and balance one or more of Pb, Bi, In, Cd, Sb, and Sn. The Examiner argues that the fuse composition consisting of Ag or Au, Sb, In, Sn, and Bi does not contain Pb or Cd as required. The Examiner demonstrates in Table 2 below that the compositions of JP '035 and the presently claimed composition overlap.

Table 2: Examiner's Comparison of JP '035 Alloy and Presently Claimed Alloy

Element	Present Invention	JP '035	Overlapping Range
Claim 1		abstract	
In	15-37%	0.01-30%	15-30%
Sn	5-28%	0.01-40%	5-28%
Bi	balance	0.01-50%	28-50%
Claim 2		abstract	
Ag or Au	0.1-3.5%	0.01-10%	0.1-3.5%
Sb	0.1-3.5%	0.01-15%	0.1-3.5%

Therefore, the Examiner concludes that it would have been obvious to one skilled in the art to select the claimed alloy fuse composition from the disclosed ranges of JP '035 because JP '035 teaches the same utility (an alloy fuse composition) throughout the whole disclosed range.

The Examiner also argues that the fuses of JP '035 are formed from alloys and would inherently be sensitive to temperature and thus qualify as alloy type thermal fuses.

Finally, the Examiner argues that JP '437 teaches fuse compositions which overlap with the claimed compositions, allegedly teaching a fuse element consisting of a specified amount of Al and Cu and a balance of one or more of Pb, Bi, In, Cd, Sb, and Sn. The Examiner argues that the fuse composition consisting of Cu, Sb, In, Sn, and Bi does not contain Pb or Cd as required. The Examiner demonstrates in Table 3 below that the compositions of JP '437 and the presently claimed composition overlap.

Table 3: Examiner's Comparison of JP '437 Alloy and Presently Claimed Alloy

Element	Present Invention	JP '437	Overlapping Range
Claim 1		abstract	
In	15-37%	0.01-30%	15-30%
Sn	5-28%	0.01-40%	5-28%
Bi	balance	0.01-50%	26.5-50%
Claim 2		abstract	
Cu	0.1-3.5%	0.01-2%	0.1-2%
Sb	0.1-3.5%	0.01-15%	0.1-3.5%

Therefore, the Examiner concludes that it would have been obvious to one skilled in the art to select the claimed alloy fuse composition from the disclosed ranges of JP '437 because JP '437 teaches the same utility (an alloy fuse composition) throughout the whole disclosed range. The Examiner also argues that the fuses of JP '437 are formed from alloys and would inherently be sensitive to temperature and thus qualify as alloy type thermal fuses.

In response to Applicants' previous arguments that the primary references do not teach the alloy compositions of the present invention, the Examiner argues that in the abstracts, each of the references teaches "the balance being one or more kinds of metals among...", and thus concludes that Pb and Cd may be excluded. Applicant respectfully traverses these rejections as follows.

Despite the teachings in the English abstracts of JP '034, JP '035, and JP '437 relied upon by the Examiner, each of the primary references only discloses alloy compositions of Pb alloys. The use of such alloys makes it possible to conduct a drawing process for drawing the alloy into a thin wire in order to produce a fuse used for a semiconductor device or an electronic part. As

shown in Tables 1 and 2 of JP '035, Table 1 of JP '034, and Table 1 of JP '437, all of the exemplified alloys contain Pb. Accordingly, none of the primary references teaches or suggests all of the elements of the present claims, which explicitly exclude Pb.

Additionally, the fuses taught by all of the primary references are current fuses, which are not alloy type thermal fuses as claimed, and Applicant again respectfully traverses the Examiner's unsubstantiated conclusion that the prior art alloys would inherently function as alloy type thermal fuses. Alloy type thermal fuses and current fuses (conductors for fuses) are completely different from each other in several aspects, including operating temperature, flux, and resistance.

Thermal fuses operate at predetermined temperatures (i.e., 75 to 120°C) before abnormal heat generation occurs in the fuse element in order to prevent abnormal heat generation of an electrical appliance or a circuit element thermally contacted by the thermal fuse. All of the primary references disclose that a material having a melting point below 700°C (which is much higher than 120°C) is used as a fuse element material. English translations of the relevant portions of the primary references are included below for the Examiner's convenience.

For example, JP '034 teaches:

> In a conductor for a fuse according to the present invention, Cu is 0.01 to 2 wt%, and the balance is at least one or more kinds of low-melting fusible metals. When a Cu content is less than 0.01wt%, it has only a little effect of contributing to improvement of a tensile strength required for a fuse conductor. In the alloy composition in which a Cu content is beyond (or more than) 2wt%, the temperature wherein the liquid phase has been established is beyond 700°C. In other words, it is beyond a melting temperature which is appropriate for a fuse conductor. (JP '034, page 2, upper right column, lines 4-12)

Further, JP '035 teaches:

> In a conductor for a fuse according to the present invention, Al is 0.01 to 10 wt%, Au or Ag is 0.01 to 60 wt%, and the balance is at least one or more kinds of low-melting fusible metals. The reason that an Al content is 0.01 to 10 wt% is that, when an amount of Al is less than 0.01 wt%, there is no effect of facilitating production of continuously thinning a wire; and on the other hand, a case of an amount of Al being beyond 10 wt% makes it difficult to realize production of continuously thinning a wire. When an Au or Ag content is less than 0.01 wt%, it has only a little effect of contributing to improvement of a tensile strength required for a fuse conductor. In the alloy composition in which an Au or Ag

content is beyond 60 wt%, the temperature wherein the liquid phase has been established is beyond 700°C. In other words, it is beyond a melting temperature which is appropriate for a fuse conductor. (JP '035, page 2, lower left column, lines 5-18)

Finally, JP '437 teaches:

In a conductor for a fuse according to the present invention, Al is 0.01 to 2 wt%, Cu is 0.01 to 2 wt%, and the balance is at least one or more low-melting fusible metals. The reason of setting an Al content as 0.01 to 2 wt% is as below. When an Al content is less than 0.01 wt%, it has only a little effect of facilitating production of continuously thinning a wire. On the other hand, when an Al content is more than 2 wt%, it is difficult to realize production of continuously thinning a wire. When a Cu content is less than 0.01 wt%, it has a little effect of contributing to improvement of a tensile strength required for a fuse conductor. In the alloy composition in which Cu is beyond (or more than) 2 wt%, the temperature wherein the liquid phase has been established is beyond 700°C. In other words, it is beyond a melting temperature which is appropriate for a fuse conductor. (JP '427, page 2, at page 2, lower left column, lines 1-13)

It can be seen that all of the primary references teach that when the melting point of the alloy is greater than 700° C, it is not suitable for a thermal fuse element material. None of the primary references teaches or suggests the operating temperature of the fuse element material. Accordingly, one could not assume that such fuses would inherently operate at a predetermined temperature before abnormal thermal heat generation occurs in the fuse element, which is necessary for a thermal fuse. When the operating temperature is unknown, a fuse cannot be used as a thermal fuse.

A second important difference between thermal fuses and current fuses is that alloy type thermal fuses utilize a flux for their operation. As described in paragraph [0002] of the present application, when an electrical appliance, for example, generates heat by an abnormality, the flux is activated, leading to wettability with respect to the electrodes. As a result, the thermal flux is divided and spheroidized. The fuse element alloy thus melts when an abnormally high level of heat is generated in the electrical appliance, thereby opening an electric current. The amount of In in an alloy composition for a thermal fuse must be controlled so that In, which is highly reactive, will not react with the flux in the surface of the fuse element and form an In salt.

In contrast, current fuses (as taught by the primary references) function by instantaneously breaking a wire when an overload current which is over a rated current is

applied. These fuses thus blow out the fuse element by self-heating (or Joule's heat) of the fuse element, and thus flux is not necessary. In fact, if there is a flux in such a fuse, it is carbonized, thereby decreasing the insulation characteristics of a case. A flux is thus not only unnecessary, but undesirable in a current fuse.

Finally, in an alloy thermal fuse, when the resistance is high, an amount of self-heating occurs, such that the fuse operates at a temperature which is lower than the predetermined operating temperature. It is thus desirable that the resistance of an alloy type thermal fuse be low. As described in paragraph [0049] of the present application, alloy thermal fuses according to the presently claimed invention showed no remarkable change (50% or more) in resistance.

In contrast, in the current fuses according to the prior art, the resistance is desirably high because the fuses are blown out by self-heating. Each of the primary references teaches that high resistance is required as a conductor for a fuse. Specifically, JP '034, JP '035, and JP '437 all teach:

> A conductor for a fuse according to the present invention has excellent fusing characteristics and excellent wire drawability. Moreover, the present invention can make a wire thin or extremely thin whereby a high resistance is requested as a conductor for a fuse, and the present invention is effectively used in the field, which requires a thin wire or an extremely thin wire. Especially, it is effectively used for a case that, in a semiconductor apparatus (such as an IC, and a transistor) or an electronic part (including a capacitor or the like), it is requested to add a fuse function to original functions of themselves. As a result, it is not necessary to dispose an apparatus having a fuse function, conventionally disposed separately from a semiconductor apparatus and an electronic part, and incorporated into a circuit of an electronic apparatus. This can decrease the number of parts and realize production of the electronic apparatus having high reliability. (JP '034, page 2, lower left column, lines 6-18; JP '035, page 2, lower right column, line 12 to page 3, upper left column, line 4; JP '437, page 2, lower right column, lines 7-19)

For all of these reasons, the alloys of the primary references would not function as materials for thermal fuse elements. None of the primary references teaches or suggests an alloy type thermal fuse as claimed and one skilled in the art would not select the prior art fuses for use as thermal fuses. Accordingly, reconsideration and withdrawal of the § 103(a) rejections are respectfully requested.

Rejections Under § 103(a) Based on JP '035, JP '034, and JP '437 in view of JP '940, GB '608, and/or JP '732

Regarding claims 7-10, 15-22, and 51-54, the Examiner acknowledges that the elements recited in these claims are not taught by the primary references. However, the Examiner maintains that it would have been obvious to modify the alloys or fuses taught by the primary references to incorporate these elements, which are allegedly taught by JP '940, GB '608, and/or JP '732 for the reasons set forth previously on the record. Applicant again respectfully traverses these rejections as follows.

First, as previously explained, none of the primary references teaches or suggests all of the elements of independent claim 1, namely, an alloy type thermal fuse having a specific alloy composition which does not intentionally contain Pb or Cd. Further, these elements are also not taught by the secondary references cited by the Examiner. For example, JP '940 relates to a thin metallic film which may be provided on the surface of lead wires. Further, JP '732 teaches an alloy temperature fuse with a specific structure, and GB '608 relates to heating circuits and is completely silent as to alloy thermal fuses. Accordingly, none of the secondary references cures the deficiencies with the primary references, and even the proposed combinations of references would not teach or suggest all of the claimed elements.

Additionally, regarding claims 15-22, the Examiner argues that it would have been obvious to have modified the primary references by providing a resistor to blow a thermal fuse in order to terminate heating in a heating circuit. To the contrary, as previously explained, the primary references teach current fuses, not thermal fuses, and there would have been no motivation to add a resistor to a current fuse in order to terminate heating in a heating circuit.

Finally, regarding claims 51-58, the Examiner argues that it would have been obvious to modify the fuses of the primary references to add a flux to the fuse element, as taught by JP '732. The Examiner is completely misunderstanding he difference between current fuses and thermal fuses. As previously explained, not only is flux not needed in current fuses, as taught by the primary references, but actually would render the resulting fuse unfit for its intended use. Upon self-heating, the flux would carbonize, thereby decreasing the insulation characteristics of the case. Accordingly, there would have been no motivation to modify the fuses of the primary

references to decrease their effectiveness by including flux, as suggested by the Examiner.

For all of these reasons, reconsideration and withdrawal of the § 103(a) rejections are respectfully requested.

In view of the preceding Remarks, it is respectfully submitted that the pending claims are patentably distinct from the prior art of record, and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,

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